

CLAIMS

What is claimed is:

1. A receiver portion for selectively converting a GPS signal and a second rf
10 signal to a lower frequency signal in a wireless handset, comprising:
a GPS control signal generator for generating a GPS control signal;
a band select switch coupled to the GPS control signal generator
for selecting the GPS signal or the second rf signal, responsive to the GPS
control signal;
15 a mixer coupled to the band select switch for receiving the selected
signal and to a local oscillator for converting the selected signal to the
lower frequency signal;
a GPS antenna assembly for receiving the GPS signal; and
a second rf signal antenna assembly for receiving the second rf
20 signal.
2. The receiver portion of claim 1, wherein the GPS antenna assembly and
the second rf signal antenna assembly comprise the same antenna
assembly.
3. The receiver portion of claim 1, wherein the second rf signal is a PCS
25 signal.
4. The receiver portion of claim 1, wherein the lower frequency signal is an
IF signal.
5. The receiver portion of claim 4, wherein the second rf signal is a PCS
signal.
6. The receiver portion of claim 4, further comprising:
30 an IF filter constructed to filter the IF signal.
7. The receiver portion of claim 6, wherein:
a low side injection of a local oscillator is used for mixing the GPS
signal down to the IF signal.
8. The receiver portion of claim 7, wherein:
35

5 an oscillating frequency of the local oscillator is substantially equal to 1391 MHz.

9. The receiver portion of claim 5, wherein:

a high side injection of a local oscillator is used for mixing the PCS signal down to the IF signal.

10 10. The receiver portion of claim 9, wherein:

an oscillating frequency of the local oscillator is substantially equal to 2144 MHz.

11. The receiver portion of claim 4, wherein:

the IF signal is substantially equal to 183.6 MHz.

15 12. The receiver portion of claim 3, further comprising:

a GPS low noise amplifier coupled to the GPS antenna and to the band select switch for amplifying the GPS signal;

a PCS low noise amplifier coupled to the PCS antenna and to the band select switch for amplifying the PCS signal;

20 a power supply for supplying power to the GPS low noise amplifier and to the PCS low noise amplifier

wherein:

the GPS control signal generator is coupled:

25 to a power line of the GPS low noise amplifier for coupling the power supply to the GPS low noise amplifier when the GPS control signal is on and;

to a power line of the PCS low noise amplifier for coupling the power supply to the PCS low noise amplifier when the GPS control signal is off.

30 13. A receiver portion for converting an RF signal to an intermediate frequency signal in a wireless communication device, comprising:

a GPS control signal generator for generating a GPS control signal;

a diplexer for isolating a GPS signal from a second rf signal;

a local oscillator for generating a local oscillator signal;

35 a mixer, coupled to the diplexer for receiving the GPS signal and the second rf signal and to the local oscillator for receiving the local

- 5 oscillator signal, for converting the received signals into a lower frequency signal;
- a lower frequency signal filter coupled to the mixer and constructed to transmit a lower frequency signal that is indicative of a selected signal that is a member of the group consisting of the GPS signal
- 10 and the second rf signal;
- a GPS antenna assembly for receiving the GPS signal; and
- a second rf signal antenna assembly for receiving the second rf signal.
14. The receiver portion of claim 13, wherein the GPS and the second rf signal antenna assemblies are the same antenna assembly.
15. The receiver portion of claim 13, wherein the lower frequency signal is an IF signal.
16. The receiver portion of claim 13, wherein the second rf signal is a PCS signal.
- 20 17. The receiver portion of claim 15, wherein the second rf signal is a PCS signal.
18. The receiver portion of claim 15, wherein:
- a low side injection of the local oscillator is used for mixing the GPS signal down to the IF signal.
- 25 19. The receiver portion of claim 13, wherein:
- an oscillating frequency of the local oscillator is substantially equal to 1391 MHz.
20. The receiver portion of claim 17, wherein:
- a high side injection of the local oscillator is used for mixing the PCS signal down to the IF signal.
- 30 21. The receiver portion of claim 15, wherein:
- the IF signal is substantially equal to 183.6 MHz.
22. The receiver portion of claim 16, further comprising:
- a GPS low noise amplifier coupled to the GPS antenna and to the
- 35 diplexer for amplifying the GPS signal;

5

a PCS low noise amplifier coupled to the PCS antenna and to the
duplexer for amplifying the PCS signal;

a power supply for supplying power to the GPS low noise
amplifier and to the PCS low noise amplifier

wherein:

10

the GPS control signal generator is coupled to a power line
of the GPS low noise amplifier and to a power line of the PCS low
noise amplifier for coupling the power supply to the GPS low
noise amplifier when the GPS control signal is on and for coupling
the power supply to the PCS low noise amplifier when the GPS
control signal is off.

15

23. A receiver portion for converting a GPS signal and a second rf signal to an
intermediate frequency signal comprising:

a GPS control signal generator for generating a GPS control signal;

20

a local oscillator source configured to generate a GPS local
oscillator signal and a second rf signal local oscillator signal wherein the
GPS control signal generator is coupled to the local oscillator source for
selecting one of a member of a group consisting of the rf signal local
oscillator signal and the GPS local oscillator signal;

a GPS antenna assembly for receiving the GPS signal;

25

a second rf signal antenna assembly for receiving the second rf
signal;

a duplexer coupled to the GPS antenna assembly and to the second
rf signal antenna assembly and configured to transmit the GPS signal and
the second rf signal;

30

a mixer coupled to the local oscillator source and to the duplexer,
the mixer constructed to convert the second rf signal to a first lower
frequency signal and to convert the GPS signal to a second lower
frequency signal;

35

a band pass filter coupled to the mixer, the filter configured to
transmit one of a member of the group consisting of the first lower
frequency signal and the second lower frequency signal.

- 5 24. The receiver portion of claim 23, wherein the GPS and second rf signal antenna assemblies are the same antenna assembly.
25. The receiver portion of claim 23, wherein the lower frequency signal is an IF signal.
26. The receiver portion of claim 23, wherein the second rf signal is a PCS signal.
- 10 27. The receiver portion of claim 25, wherein the second rf signal is a PCS signal.
28. The receiver portion of claim 26, further comprising:
- a GPS low noise amplifier coupled to the GPS antenna assembly and to the duplexer for amplifying the GPS signal;
- 15 a PCS low noise amplifier coupled to the PCS antenna and to the duplexer for amplifying the PCS signal;
- a power supply for supplying power to the GPS low noise amplifier and to the PCS low noise amplifier
- wherein:
- the GPS control signal generator is coupled to a power line of the GPS low noise amplifier and to a power line of the PCS low noise amplifier for coupling the power supply to the GPS low noise amplifier when the GPS control signal is on and for coupling the power supply to the PCS low noise amplifier when the GPS control signal is off.
29. The receiver portion of claim 25, wherein:
- a low side injection of a local oscillator is used for mixing the GPS signal down to the IF signal.
- 30 30. The receiver portion of claim 23, wherein:
- an oscillating frequency of the local oscillator is substantially equal to 1391 MHz.
31. The receiver portion of claim 27, wherein:
- a high side injection of a local oscillator is used for mixing the PCS signal down to the IF signal.
- 35 32. The receiver portion of claim 26, wherein:

5

the IF signal is substantially equal to 183.6 MHz.

33. A receiver portion for receiving a GPS signal and a cellular CDMA signal comprising:

a GPS control signal generator for generating a GPS control signal;

10

a local oscillator source configured to generate a GPS local oscillator signal and a cellular CDMA local oscillator signal wherein the GPS control signal generator is coupled to the local oscillator source for selecting one of a member of a group consisting of the cellular CDMA local oscillator signal and the GPS local oscillator signal;

a GPS antenna assembly for receiving the GPS signal;

15

a cellular CDMA antenna assembly for receiving the cellular CDMA signal;

a first mixer coupled to the local oscillator source and to the GPS antenna assembly, the mixer constructed to convert the GPS signal to a first lower frequency signal;

20

a second mixer coupled to the local oscillator source and to the cellular CDMA antenna assembly, the mixer constructed to convert the GPS signal to a second lower frequency signal;

25

a band pass filter coupled to the first mixer and to the second mixer, the filter configured to transmit one of a member of the group consisting of the first lower frequency signal and the second lower frequency signal.

34. The receiver portion of claim 33, wherein the first lower frequency signal is an IF signal.

30

35. The receiver portion of claim 33, wherein the first and second mixers are the same mixer.

36. The receiver portion of claim 33 wherein the GPS and cellular CDMA antennas are the same antenna.

37. The receiver portion of claim 33, further comprising:

35

a GPS low noise amplifier coupled to the GPS antenna assembly and to the first mixer for amplifying the GPS signal;

5

a cellular CDMA low noise amplifier coupled to the cellular CDMA antenna assembly and to the second mixer for amplifying the cellular CDMA signal;

a power supply for supplying power to the GPS low noise amplifier and to the cellular CDMA low noise amplifier

10

wherein:

the GPS control signal generator is coupled to a power line of the GPS low noise amplifier and to a power line of the cellular CDMA low noise amplifier for coupling the power supply to the GPS low noise amplifier when the GPS control signal is on and for coupling the power supply to the cellular CDMA low noise amplifier when the GPS control signal is off.

15

38. The receiver portion of claim 34, wherein:

a low side injection of a local oscillator is used for mixing the GPS signal down to the IF signal.

20

39. The receiver portion of claim 38, wherein:

an oscillating frequency of the local oscillator is substantially equal to 1391 MHz.

40. The receiver portion of claim 34, further comprising:

a divide by two circuit coupled between the local oscillator source and the second mixer for dividing an initial local oscillator signal by two to produce the second local oscillator signal wherein:

25

a high side injection of a local oscillator is used for mixing the cellular CDMA signal down to the IF signal.

41. The receiver portion of claim 34, wherein:

30

the IF signal is substantially equal to 183.6 MHz.

42. The receiver portion of claim 33, further comprising:

a band select switch coupled between the GPS antenna assembly and the first mixer for selecting the GPS signal.

43. The receiver portion of claim 33, further comprising:

35

a diplexer coupled between the GPS antenna and the first mixer for coupling the GPS signal to the first mixer.

- 5 44. The receiver portion of claim 33, further comprising:
 a duplexer coupled between the GPS antenna and the first
 mixer for coupling the GPS signal to the first mixer.
45. The receiver portion of claim 33, further comprising:
 a second rf signal antenna assembly coupled to the first
10 mixer for receiving a second rf signal and to the local oscillator for
 converting, responsive to the GPS control signal, either the GPS
 signal or the second rf signal to the first lower frequency signal.
46. The receiver portion of claim 45, wherein the second rf signal comprises a
 PCS signal.
- 15 47. The receiver portion of claim 45, wherein the lower frequency signal
 comprises an IF signal.
48. The receiver portion of claim 47, wherein the second rf signal comprises a
 PCS signal.
49. The receiver portion of claim 47, further comprising:
20 a divide by two circuit coupled between the local oscillator source
 and the second mixer for dividing an initial local oscillator signal by two
 to produce the second local oscillator signal wherein:
 a high side injection of a local oscillator is used for mixing the
 cellular CDMA signal down to the IF signal.
- 25 50. A wireless handset, comprising:
 a transceiver for transmitting and receiving a plurality of rf signals;
 a battery coupled to the transceiver for supplying power to the
 transceiver; and
 a case enclosing the transceiver and the battery,
30 the transceiver comprising:
 an rf control signal generator for generating an rf control
 signal;
 a band select switch coupled to the rf control signal
 generator for selecting between the plurality of rf signals,
35 responsive to the rf control signal;

5

a mixer, coupled to the band select switch for receiving the selected signal and to a local oscillator, for converting the selected signal to an IF signal;

an antenna assembly coupled to the mixer for receiving the plurality of rf signals.

10

51. The wireless handset of claim 50, wherein the mixer is a passive mixer.

52. The wireless handset of claim 50, further comprising a low noise amplifier coupled between the band select switch and the mixer.

53. The wireless handset of claim 50, further comprising a low noise amplifier coupled between the mixer and an IF band pass filter.

15

54. The wireless handset of claim 50, wherein the plurality of rf signals comprises a GPS signal.

55. The wireless handset of claim 50, wherein the plurality of rf signals comprises a cellular CDMA signal.

56. The wireless handset of claim 50, wherein the plurality of rf signals comprises a GSM signal.

20

57. The wireless handset of claim 50, wherein the plurality of rf signals comprises a cellular CDMA signal and a GPS signal.

58. The wireless handset of claim 50, wherein the plurality of rf signals comprises a cellular CDMA signal, a GPS signal and a PCS signal.

25

59. A method of down converting a GPS signal to an intermediate frequency signal that is indicative of the GPS signal, comprising:

providing a mixer configured to convert a second rf signal and the GPS signal to a lower frequency signal;

mixing, using the mixer, the second rf signal with a first local oscillator signal;

30

generating a GPS control signal;

decoupling the second rf signal from the mixer, responsive to the GPS control signal;

mixing, using the mixer, the GPS signal with a second local oscillator signal.

35

- 5 60. The method of claim 59, wherein the second rf signal comprises a PCS
 signal.
61. The method of claim 59, wherein the lower frequency signal comprises an
 IF signal.
62. The method of claim 61, wherein the second rf signal comprises a PCS
10 signal.
63. The method of claim 62, further comprising:
 producing a first IF signal, indicative of the PCS signal;
 producing a second IF signal, indicative of the GPS signal;
 providing a filter configured to filter the first IF signal and the
15 second IF signal;
 filtering, using the filter, the first IF signal.
 filtering, using the filter, the second IF signal.
64. The method of claim 60, wherein the first step of mixing comprises:
 injecting a local oscillator signal on a low side of the PCS signal.
65. The method of claim 60, wherein the second step of mixing comprises:
20 injecting a local oscillator signal on a high side of the GPS signal.
66. A method of using a mixer and a filter for processing both a GPS signal
 and a second rf signal comprising:
 providing a mixer configured to receive the GPS signal and the
25 second rf signal;
 coupling the GPS signal and the second rf signal to the mixer;
 generating a GPS control signal;
 coupling a first local oscillator signal or a second local oscillator
 signal to the mixer responsive to the GPS control signal;
30 mixing, using the mixer, both the GPS signal and the second rf
 signal to a first IF signal and a second IF signal;
 selecting, using an IF filter, either the first or the second IF signal
 for further processing.
67. The method of claim 66, wherein the step of mixing comprises:
35 injecting the first local oscillator signal on a high side of the GPS
 signal.

5

68. The method of claim 66, wherein the second rf signal comprises a PCS signal.

69. The method of claim 68, wherein the second step of mixing comprises:
injecting the second local oscillator signal on a low side of the PCS
signal.

10

11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
841
842
843
844
845
846
847
848
849
850
851
852
853
854
855
856
857
858
859
860
861
862
863
864
865
866
867
868
869
870
871
872
873
874
875
876
877
878
879
880
881
882
883
884
885
886
887
888
889
890
891
892
893
894
895
896
897
898
899
900
901
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
921
922
923
924
925
926
927
928
929
930
931
932
933
934
935
936
937
938
939
940
941
942
943
944
945
946
947
948
949
950
951
952
953
954
955
956
957
958
959
960
961
962
963
964
965
966
967
968
969
970
971
972
973
974
975
976
977
978
979
980
981
982
983
984
985
986
987
988
989
990
991
992
993
994
995
996
997
998
999
1000